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NATIONAL DAM INSPECTION PROGRAM. BROOKVILLE WATER WORKS DAM (ND--ETC(U)
JUN 80 DACW31-80-C-0022

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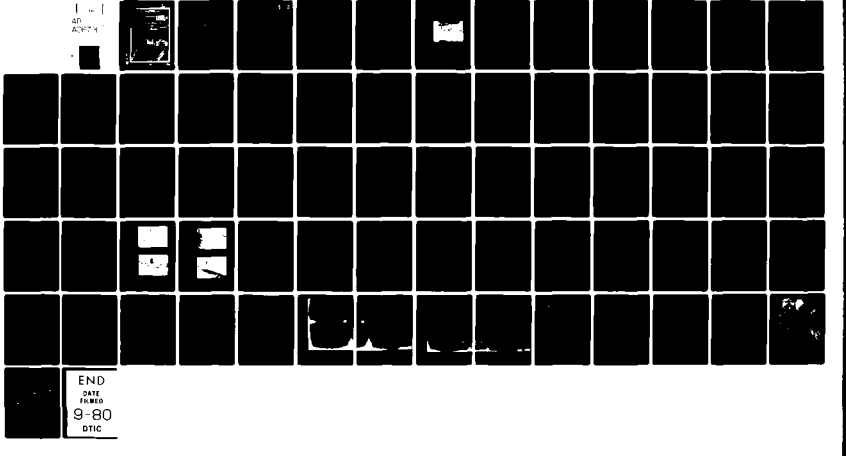

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon visual observations and review of available data. Detailed investigations and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external factors which are evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

NAME OF DAM: Brookville Water Works Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Jefferson
STREAM: North Fork Creek, a Tributary of Red Bank Creek
SIZE CLASSIFICATION: Small
HAZARD CLASSIFICATION: Significant
OWNER: Borough of Brookville
DATE OF INSPECTION: April 24, 1980 and April 30, 1980

ASSESSMENT: Based on the evaluation of the existing conditions, Brookville Water Works Dam was found to be in good condition and adequately maintained.

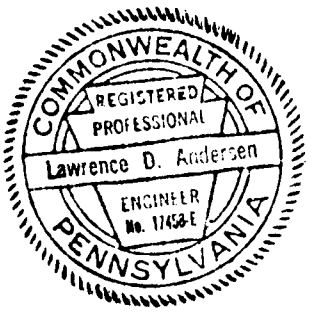
The flood discharge capacity of the dam was evaluated according to the recommended procedure and was found to pass less than the 100-year flood without overtopping the embankment portion of the dam. The recommended spillway capacity range is between the 100-year flood and 50 percent of the probable maximum flood (PMF). Considering the low downstream damage potential, the lower limit of the recommended spillway capacity range was considered to be applicable to this dam. Therefore, the flood discharge capacity is classified to be inadequate. However, considering that the slopes of the earth embankment are protected with riprap and the dam has a concrete core wall, and further that the dam has withstood overtoppings in the past without breaching, overtopping of the earth embankment during the passage of 100-year flood can be permitted. Therefore, enlargement of the spillway is not considered to be justified.

The following recommendations should be implemented on a continuing basis.

1. The toe of the spillway section should be periodically inspected by divers or by draining the tailwater pool to determine if undercutting is occurring which might affect the stability of the spillway section.

2. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert the downstream residents in the event of emergencies.

3. The dam and appurtenant structures should be inspected regularly and a formal maintenance manual should be developed for the continued maintenance of the dam.



Lawrence D. Andersen, P.E.
Vice President

June 18, 1980
Date

Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

11 July 1980
Date

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BROOKVILLE WATER WORKS DAM
NDI I.D. PA-422
DER I.D. 33-2
APRIL 24, 1980

Overview

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
BROOKVILLE WATER WORKS DAM
(NDI I.D. PA-422,
DER I.D. 33-3) Ohio River Basin, North Fork Creek, Jefferson County, Pennsylvania

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. Brookville Water Works Dam consists of a 100-foot-wide concrete gravity overflow section flanked by an earth embankment on the right side (looking downstream). The earth embankment portion is approximately 260 feet long with a maximum height of 20 feet from the invert elevation of the outlet conduit. The spillway section consists of an ogee-crested gravity section, the top of which is 8 feet below the crest of the earth embankment. The earth embankment portion has a crest width of 4 feet and side slopes of about 2.0H to 1V on both the upstream and downstream sides. The upstream and downstream sides of the earth embankment are protected by hand-placed riprap and the crest is paved with concrete.

The outlet facilities for the dam consist of a 6-foot concrete conduit located at the right end of the spillway. The invert of this conduit is located 20 feet below the top of the earth embankment. Flow through the conduit is regulated by a sluice gate on the upstream face of the dam. Other outlet facilities include a supply water intake tower (pump station suction tower) located immediately right of the outlet conduit in the upstream portion of the earth embankment. The 6-foot-diameter outlet conduit constitutes the emergency drawdown facilities for the reservoir.

b. Location. Brookville Water Works Dam is located on North Fork Creek, a tributary of Red Bank Creek, approximately 1/2 mile upstream from its confluence with Red Bank Creek in the Borough of

411991

4/5

Brookville, Jefferson County, Pennsylvania. Plate 1 illustrates the location of the dam.

c. Size Classification. Small (based on 20-foot height and 270 acre-feet maximum storage capacity).

d. Hazard Classification. The dam is classified to be in the significant hazard category. A park and picnic ground are located immediately downstream from the dam. A residence belonging to the borough water authority is also located in this area. Approximately 1/2 mile further downstream, North Fork Creek enters into a flood control project along Red Bank Creek. It is estimated that in the event of a failure of the dam under normal flow conditions, discharge would essentially be contained within the streambed.

e. Ownership. Borough of Brookville (address: Mr. Robert J. Mohney, Water Plant Director, 2 Jefferson Court, Brookville, Pennsylvania 15825).

f. Purpose of Dam. Water supply.

g. Design and Construction History. The dam was designed by Mr. Earl V. Guyther, a local civil engineer, and constructed by Henyon and Heart Construction Company from Clearfield, Pennsylvania, with completion in 1912.

h. Normal Operating Procedure. The reservoir is maintained at or above the uncontrolled spillway elevation with inflow discharging over the spillway.

1.3 Pertinent Data. Elevations referred to in this and subsequent sections of the report were calculated based on approximate field measurements assuming the spillway crest level (normal pool level) to be at Elevation 1227, USGS datum, which was interpolated from the USGS 7-1/2-minute Brookville quadrangle map.

a. Drainage Area	96.3 square miles
b. Discharge at Dam Site (cfs)	
Maximum known flood at dam site	12,000 (July 17, 1912)
Outlet conduit at maximum pool	650
Gated spillway capacity at maximum pool	Not applicable
Ungated spillway capacity at maximum pool	7550
Total discharge capacity at maximum pool	8200

c. Elevation (USGS Datum) (feet)

Top of dam	1234.6 (measured low spot); 1235 (as designed)
Maximum pool	1235
Normal pool	1227
Upstream invert outlet works	1215±
Downstream invert outlet works	1215±
Maximum tailwater	Unknown
Toe of Dam	1215±

d. Reservoir Length (feet)

Normal pool level	800
Maximum pool level	1500± (estimated)

e. Storage (acre-feet)

Normal pool level	50
Maximum pool level	270

f. Reservoir Surface (acres)

Normal pool level	18
Maximum pool level	50±

g. Dam

Type	Earth
Length	260 feet (length of earth embankment)
Height	20 feet
Top width	4 feet
Side slopes	2.0H:1V (both downstream and upstream faces)
Zoning	No
Impervious core	Yes
Cutoff	Yes
Grout Curtain	No

h. Regulating Outlet

Type	72-inch concrete conduit
Length	20± feet
Closure	Upstream sluice gate
Access	From crest of dam
Regulating facilities	Sluice gate

i. Spillway

Type	Ogee overflow section
Length	100 feet (perpendicular to flow)
Crest elevation	1227
Upstream channel	Lake
Downstream channel	Earth channel

SECTION 2
DESIGN DATA

2.1 Design

a. Data Available. The available data consist of files provided by the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER), which contain a partial set of design drawings, correspondence, and past inspection reports. The available information also includes maintenance records of the dam maintained by the owner and design drawings provided by the owner.

(1) Hydrology and Hydraulics. The available information includes the design capacity of the spillway.

(2) Embankment. The available information consists of design drawings and a description of the embankment included in the past inspection reports.

(3) Appurtenant Structures. The available information consists of drawings and description of the appurtenant structures included in the previous inspection reports.

b. Design Features

(1) Embankment. Plate 2 illustrates the plan of the embankment which is located on the right side of the spillway. No drawings were available on the design of the embankment. A Commonwealth report dated October 6, 1915, describes the embankment as a homogeneous earth-fill with a central reinforced concrete core wall. The concrete core wall is reported to have a top width of 9 inches, about one foot below the dam crest level. The sides of the wall are battered 3/4 inch in one foot with reinforcing on both faces. No information was found to indicate to what depth the core wall was extended. Similarly, no information was found on the details of the method of preparing the foundation or the method of construction of the embankment. Presently, the crest of the dam is protected by a concrete walkway and the upstream and downstream slopes with hand-placed riprap. The riprap on the upstream face is grouted.

(2) Appurtenant Structures. The details of the spillway structures and the bypass conduit are illustrated in Plates 3 and 4. Drawings show the spillway section to be 100 feet wide between abutments. It has an ogee overflow section 8 feet below the top of the embankment. The ogee overflow section, which is approximately 9.5 feet high above the original ground surface, was constructed

integrally with a 9-foot-wide flip bucket section along the downstream toe of the ogee overflow section. The combined base width of the ogee overflow section and integral flip bucket is shown to be approximately 17 feet. The base was carried down from 4 to 7 feet below the natural ground surface and was keyed into the foundation by three 2-foot-wide, 1-foot-deep keys.

The outlet facilities for the reservoir consist of a 6-foot-diameter concrete conduit at the right end of the spillway. The invert of the conduit is approximately 20 feet below the top of the embankment. Flow through the outlet conduit is controlled by a sluice gate on the upstream side of the dam. Other appurtenant facilities include a supply water intake tower immediately to the right of the outlet conduit.

c. Design Data

(1) Hydrology and Hydraulics. The available records indicate the spillway capacity to be 8136 cfs based on an 8-foot head over the crest of the spillway and a spillway coefficient of 3.6.

(2) Embankment. No design information is available for the earth embankment section of the dam. A post-construction engineering study conducted to investigate the stability of the gravity section reports the factor of safety against overturning under maximum pool conditions to be 1.7 and foundation shear stresses to be 6 psi.

(3) Appurtenant Structures. Other than the hydraulic and stability calculations referred to above, no design data are available on the appurtenant structures.

2.2 Construction. Available records indicate that the dam was constructed in accordance with the design drawings. However, no other information is available on the details of the construction.

2.3 Operation. Formal operating records are maintained by the owner indicating major repairs and significant flows through the dam. According to the records, the earth embankment section of the dam was overtopped by approximately 18 inches during a flood on July 17, 1912. Although the spillway section incurred no visible damage, the downstream side of the earth embankment suffered significant erosion. The embankment portion was also overtopped during floods in 1936 and 1964 with minor damage to the earth embankment.

2.4 Other Investigations. In 1915, a postengineering study was conducted to investigate the stability of the spillway section against overturning and sliding. The factor of safety against overturning under maximum pool conditions is reported to be 1.7.

2.5 Evaluation

a. Availability. The available information was provided by PennDER and the owner.

b. Adequacy

(1) Hydrology and Hydraulics. Available information consists of the design capacity of the spillway. This information is not considered to be sufficient to assess the adequacy of the spillway.

(2) Embankment. No design data are available to assess the structural design of the earth embankment. A post-construction engineering analysis conducted to evaluate the stability of the gravity overflow section was reviewed and it was found that the analysis did not consider any uplift pressures at the base of the overflow section. This finding raised concern as to the adequacy of the stability calculations.

(3) Appurtenant Structures. Other than the stability analysis referred to above, no design data are available to assess the structural adequacy of the appurtenant structures.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of Brookville Water Works Dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.

2. Visual examination of the spillway structures.

3. Evaluation of downstream area hazard potential.

Plate 5 illustrates some of the existing features of the dam.

b. Embankment. The embankment was found to be in good condition and is adequately maintained. No signs of distress were observed.

The crest of the dam was surveyed relative to the spillway crest elevation and it was found that the dam crest was essentially at the design crest level with a minor low spot located at the right abutment embankment interface. The dam crest profile is illustrated in Plate 6. The downstream and upstream slopes were surveyed and were found to be reasonably within the design slope of 2H to 1V.

c. Appurtenant Structures. The spillway structures could only be inspected from each abutment because deep tail water precluded closer inspection. To the extent that can be determined from the abutments, the spillway structures appear to be structurally in good condition. The operating equipment for the bypass conduit and supply lines was found to be adequately maintained and in good condition.

d. Reservoir Area. The reservoir is situated in a narrow, deep valley with adjacent ridges about 300 to 400 feet above the lake level. No indications of landslide activity in the reservoir area were observed. A review of the regional geology is included in Appendix F.

f. Downstream Channel. Below the dam, North Fork Creek flows south joining Red Bank Creek approximately 1/2 mile downstream from the dam. A further description of the downstream conditions is included in Section 1.2d.

3.2 Evaluation. The overall condition of the dam is considered to be good. Due to deep tailwater conditions, the spillway structures could not be adequately inspected. It is therefore recommended that the owner periodically draw down the tailwater pool and inspect the downstream toe of the overflow section to determine if undercutting of the spillway section is occurring.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. There are no formal operating procedures for the dam. As it presently exists, the reservoir is maintained at or above the crest level of the uncontrolled spillway.

4.2 Maintenance of the Dam. The visual observations indicate that the dam is adequately maintained. A maintenance and operating log is maintained by the dam tender.

4.3 Maintenance of Operating Facilities. The operating facilities, which consist of an outlet pipe, sluice gate, and supply line intake valves, were found to be adequately maintained. The operation of the outlet conduit sluice gate was not observed.

4.4 Warning System. No formal warning system exists for the dam. Telephone communication facilities are available via the water treatment plant located at the dam site.

4.5 Evaluation. The visual observations indicate that the dam is adequately maintained. Periodic evaluation of the operational condition of the outlet conduit sluice gate and inspection of the toe of the spillway section is recommended.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Brookville Water Works Dam has a watershed area of 96.3 square miles and impounds a reservoir with a surface area of 18.4 acres at normal pool level. The flood discharge facilities consist of a 100-foot-wide ogee-crested overflow section. The capacity of the spillway, based on the available 7.9 feet of freeboard to the top of dam, was determined to be 7543 cfs, as included in the computer output in Appendix D.

b. Experience Data. As previously stated, Brookville Water Works Dam is classified as a small dam in the significant hazard category. Under the recommended criteria for evaluating spillway discharge capacity, such impoundments are required to pass from the 100-year flood to one-half PMF. Considering the downstream hazard potential, the lower limit of the recommended range is applicable to this dam.

The PMF inflow hydrograph for the reservoir was determined utilizing the Dam Safety Version of the HEC-1 computer program developed by the Hydrologic Engineering Center of the U.S. Army, Corps of Engineers. The data used for the computer analysis are presented in Appendix D. The one-half PMF inflow hydrograph was found to have a peak flow of 42,000 cfs. The 100-year flood, calculated according to the recommended procedure, was found to have a peak flow of 11,000 cfs. Computer input and a summary of computer output for the PMF analysis and the 100-year flood calculations are included in Appendix D.

c. Visual Observations. No conditions were observed that would indicate that the capacity of the spillway would be significantly reduced in the event of a flood.

d. Overtopping Potential. Various percentages of the PMF inflow hydrograph were routed through the reservoir, and it was found that the spillway can pass about 10 percent of the PMF without overtopping the embankment. This capacity corresponds to less than the 100-year flood. Therefore, the capacity of the spillway is classified to be inadequate. It is estimated that during the passage of the 100-year flood, the earth embankment section would be overtopped for a duration of about 6 to 8 hours with a maximum depth of 1.5 feet. However, considering that the earth embankment has a concrete core wall and the downsteam face has been provided with riprap erosion protection, and that the dam withstood past overtoppings without breaching, overtopping of the earth embankment during

the passage of 100-year flood can be permitted. Therefore, enlargement of the spillway is not considered to be justified. It is estimated that full flow through the spillway would cause the park and picnic grounds immediately below the dam to be partially flooded. With flow overtopping the earth embankment section, full inundation of the picnic grounds can be expected.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, the dam was found to be in good condition, revealing no signs of distress.

(2) Appurtenant Structures. Due to deep tailwater, the spillway structures could only be inspected from the abutments. To the extent that could be determined, the spillway structures appear to be in good condition.

b. Design and Construction Data

(1) Embankment. The available information does not include any quantitative data to aid in the assessment of the structural stability of the earth embankment section. However, as noted above, the earth embankment was found to be in good condition, revealing no signs of distress. Therefore, based on visual observations, the stability of the earth embankment section is considered to be satisfactory. A preliminary analysis was conducted to determine the stability of the gravity overflow section. The stability calculations for the spillway section are included in Appendix D. The calculations indicate that under 100-year flood loading conditions, the result would be within the middle one-third of the base and the factor of safety against sliding would be 2.9. Further, considering that the analysis was based on the minimum foundation embedment length and that it was reported that the foundation embankment depth ranged up to 7 feet, increasing the sliding resistance of the spillway, the overall stability of the dam is considered to be satisfactory.

(2) Appurtenant Structures. The appurtenant structures were found to be in good condition.

c. Operating Records. Formal operating records are maintained by the owner which indicate major repairs to the dam and large flows through the spillway. According to the records, the largest flow at the dam site occurred in 1912 when the earth embankment portion was overtopped by approximately 18 inches. It is indicated that the earth embankment section suffered significant damage, while no damage was noted in the spillway section.

d. Post-Construction Changes. None reported.

e. Seismic Stability. The dam is located in Seismic Zone 1, and based on visual observations, the static stability of the dam appears to be adequate. Therefore, based on the recommended criteria for the evaluation of seismic stability of dams, the structure is presumed to present no hazard as a result of earthquakes.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that Brookville Water Works Dam is in good condition and is adequately maintained. The spillway capacity was evaluated according to the recommended criteria and was found to be less than the recommended spillway capacity of the 100-year flood. Therefore, the spillway is classified as inadequate. However as previously discussed, enlargement of the spillway is not considered to be required.

b. Adequacy of Information. Available information, in conjunction with visual observations and the previous experience of the inspectors, is considered to be sufficient to make the following recommendations.

c. Urgency. The following recommendations should be implemented on a continuing basis.

d. Necessity for Additional Data. None required.

7.2 Recommendations/Remedial Measures. It is recommended that the following recommendations be implemented on a continuing basis:

1. The toe of the spillway section should be periodically inspected by divers or by draining the tailwater pool to determine if undercutting is occurring which might affect the stability of the spillway section.

2. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system should be developed to alert the downstream residents in the event of emergencies.

3. The dam and appurtenant structures should be inspected regularly and a formal maintenance manual should be developed for the continued maintenance of the dam.

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Brookville Water Works Dam COUNTY Jefferson STATE Pennsylvania ID# NDI I.D. PA-422
DER I.D. 33-3

TYPE OF DAM Earth HAZARD CATEGORY Significant

DATE(S) INSPECTION April 24, 1980 WEATHER Sunny TEMPERATURE 60s

POOL ELEVATION AT TIME OF INSPECTION 1128± M.S.L. TAILWATER AT TIME OF INSPECTION 1220± M.S.L.

INSPECTION PERSONNEL:	REVIEW INSPECTION PERSONNEL: (April 30, 1980)
B. Erel	E. D'Appolonia
W. T. Chan	L. D. Andersen
	J. H. Poellot

OWNER'S REPRESENTATIVE: B. Erel

Robert J. Mohney, Water Plant Director

B. Erel RECORDER

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	See Plate 6.	
RIPRAP FAILURES	None	

VISUAL INSPECTION
PHASE I
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No signs of distress.	
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Outlet conduit is partially submerged. Not accessible for inspection.	
INTAKE STRUCTURE	Submerged	
OUTLET STRUCTURE	The outlet conduit has no outlet structure.	
OUTLET CHANNEL	None	
EMERGENCY GATE	Sluice gate on the upstream side of the dam (operation of the sluice gate was not observed).	

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	In good condition.	
APPROACH CHANNEL	Lake	
DISCHARGE CHANNEL	Natural streambed	
BRIDGE AND PIERS	None	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable	
APPROACH CHANNEL	Not applicable	
DISCHARGE CHANNEL	Not applicable	
BRIDGE PIERS	Not applicable	
GATES AND OPERATION EQUIPMENT	Not applicable	

VISUAL INSPECTION
PHASE I
INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

VISUAL INSPECTION
PHASE I
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle to moderately steep. No significant shoreline erosion was noted.	
SEDIMENTATION	Unknown	
UPSTREAM RESERVOIRS	None	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is in good condition.	
SLOPES	No features pertinent to the safety of the dam.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	There is one home within the potential flood plain of the dam. A city park is located immediately downstream from the dam.	

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
AND HYDROLOGIC AND HYDRAULIC
PHASE I

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Brookville Water Works

ID# NDI I.D. PA-422
DER I.D. 33-3

ITEM	REMARKS
AS-BUILT DRAWINGS	Available in Commonwealth and the owner's files.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	The dam was designed by a local engineer and built by Henyon and Heart Construction Company from Clearfield, Pennsylvania, with completion in 1912.
TYPICAL SECTIONS OF DAM	See Plates 3 and 4.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	See Plates 3 and 4.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	Major flows through the spillway are recorded in the maintenance log for the dam.
DESIGN REPORTS	None prepared
GEOLOGY REPORTS	None prepared
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	A post-construction engineering analysis conducted to evaluate the stability of the spillway sections is included in the Commonwealth files.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None reported

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None reported
BORROW SOURCES	Unknown
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	Major floods are recorded in the operating log.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	In 1915, the stability of the spillway overflow section was reevaluated.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	The dam was overtopped in 1912, 1936, and 1964. It is reported that while the 1912 overtopping caused significant damage, only minor damage was incurred in the subsequent overtoppings.
MAINTENANCE OPERATION RECORDS	Maintained by the owner.
SPILLWAY PLAN SECTIONS DETAILS	See Plates 3 and 4.
OPERATING EQUIPMENT PLANS AND DETAILS	Not available

CHECKLIST
ENGINEERING DATA
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 97 square miles

ELEVATION, TOP OF NORMAL POOL AND STORAGE CAPACITY: 1227 (50 acre-feet)

ELEVATION, TOP OF FLOOD CONTROL POOL AND STORAGE CAPACITY: 1235 (270 acre-feet)

ELEVATION, MAXIMUM DESIGN POOL: 1234.6

ELEVATION, TOP OF DAM: 1234.6 (measured low spot); 1235 (as designed)

SPILLWAY:

a. Elevation 1227

b. Type Concrete ogee overflow section

c. Width 100 feet (perpendicular to flow)

d. Length Not applicable

e. Location Spillover Earth embankment section on right abutment

f. Number and Type of Gates None

OUTLET WORKS:

a. Type 72-inch concrete conduit

b. Location Right end of spillway

c. Entrance Inverts 1220

d. Exit Inverts 1220±

e. Emergency Drawdown Facilities 72-inch concrete conduit

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

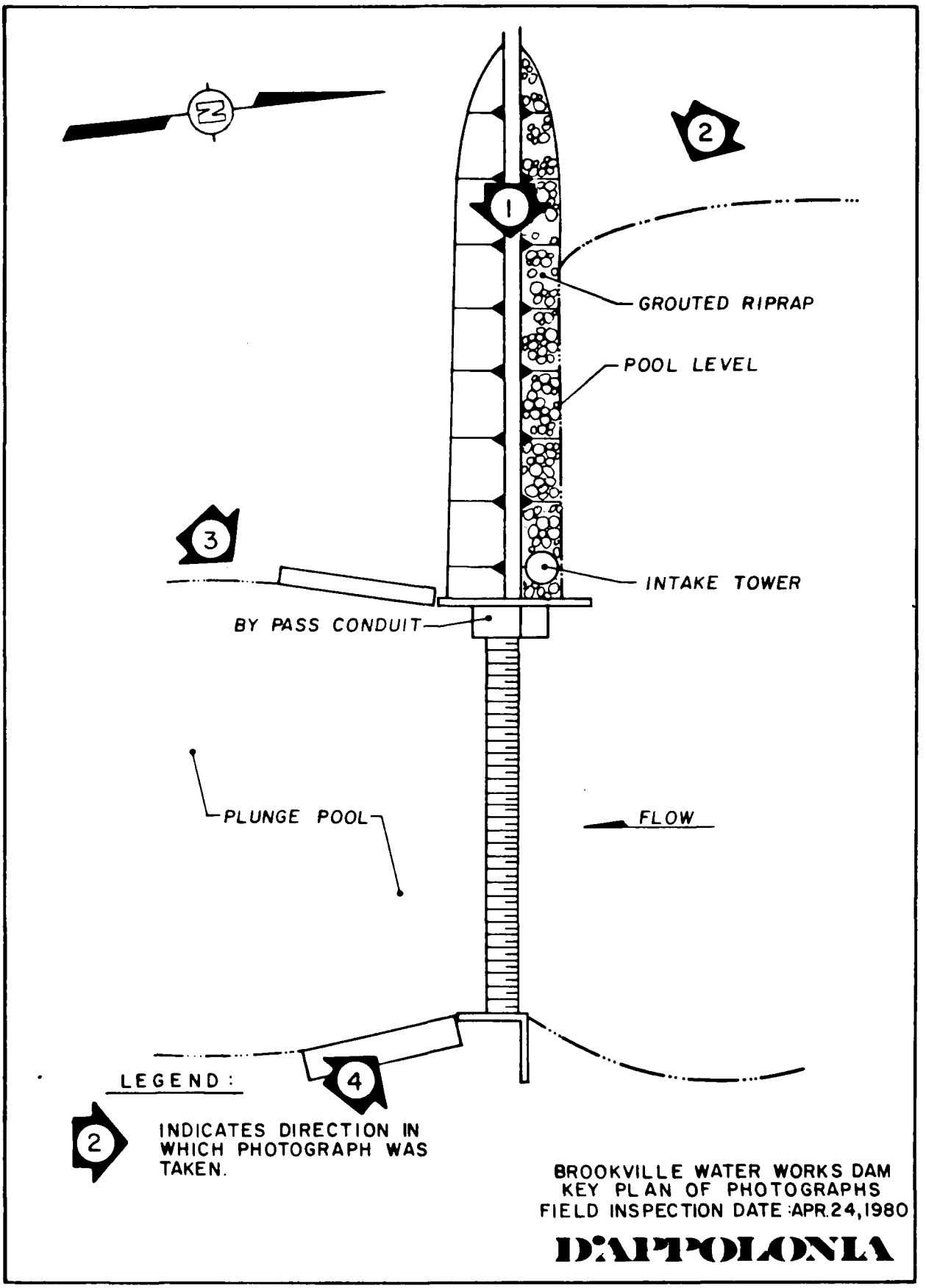
c. Records None

MAXIMUM NONDAMAGING DISCHARGE: 8300± cfs existing spillway capacity

APPENDIX C
PHOTOGRAPHS

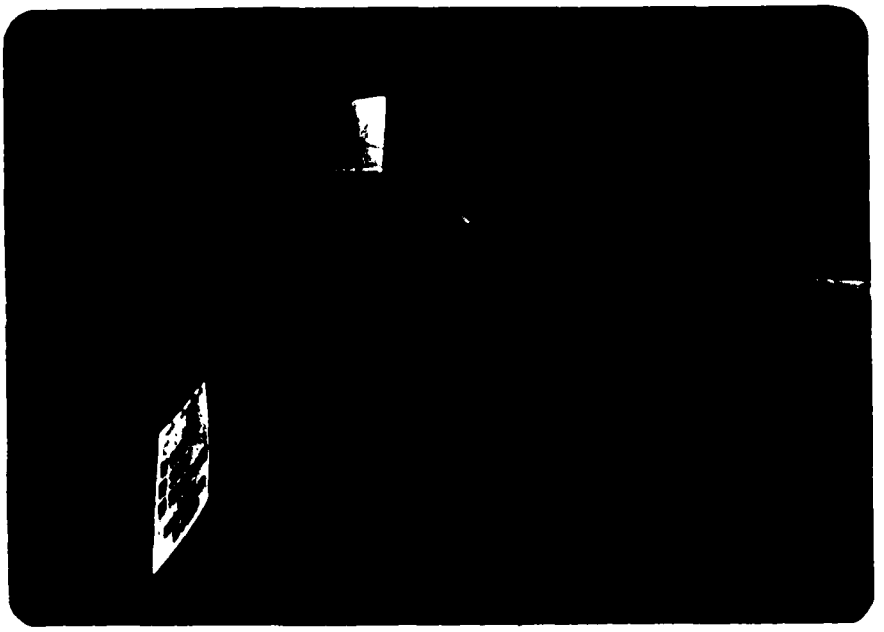
LIST OF PHOTOGRAPHS
BROOKVILLE WATER WORKS DAM
NDI I.D. PA-422
DER I.D. 33-2
APRIL 24, 1980

PHOTOGRAPH NO.	DESCRIPTION
1	Dam crest (looking east).
2	Upstream face (looking east).
3	Spillway.
4	Intake tower and bypass conduit (at right end of spillway looking downstream).



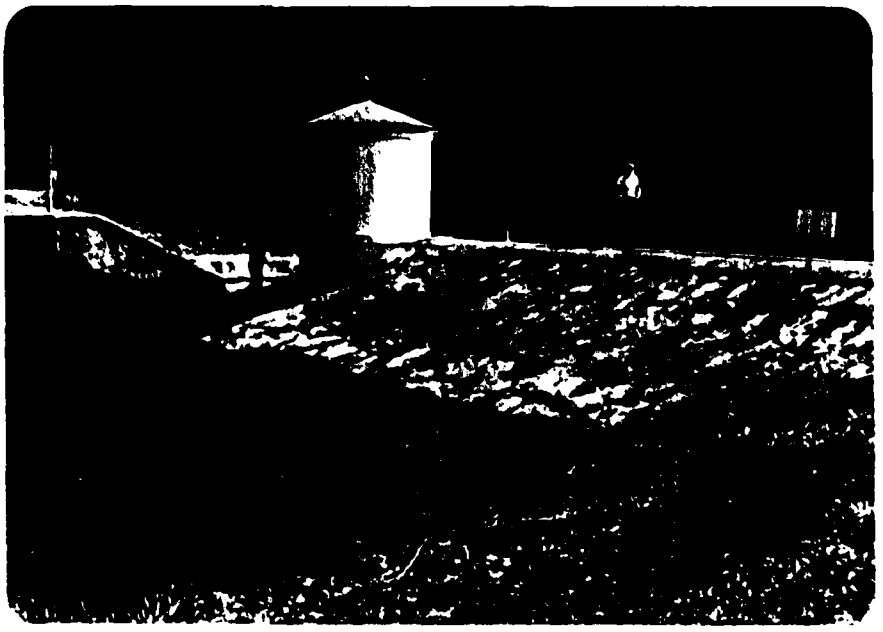
BROOKVILLE WATER WORKS DAM
KEY PLAN OF PHOTOGRAPHS
FIELD INSPECTION DATE: APR. 24, 1980

DAPPOLONIA



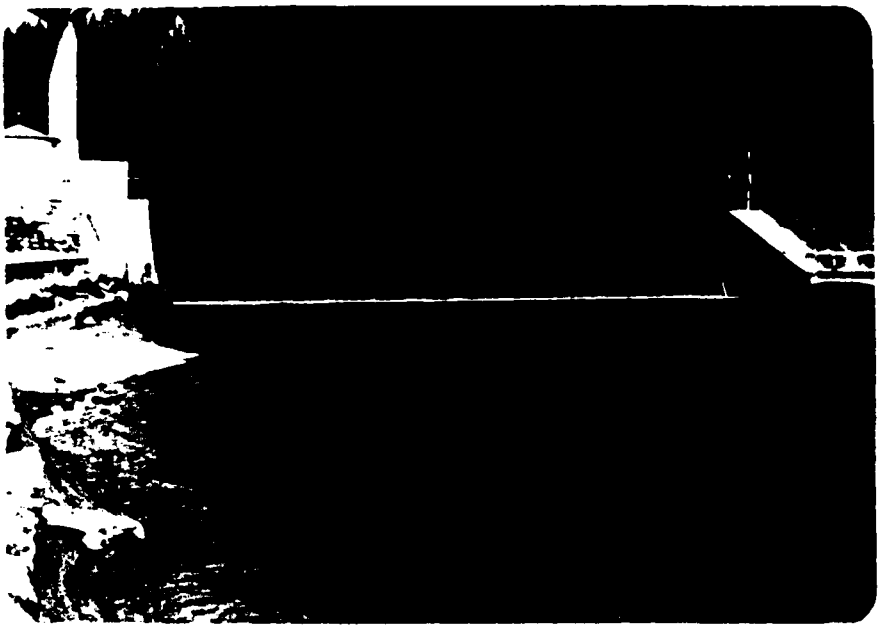
Photograph No. 1

Dam crest (looking east).



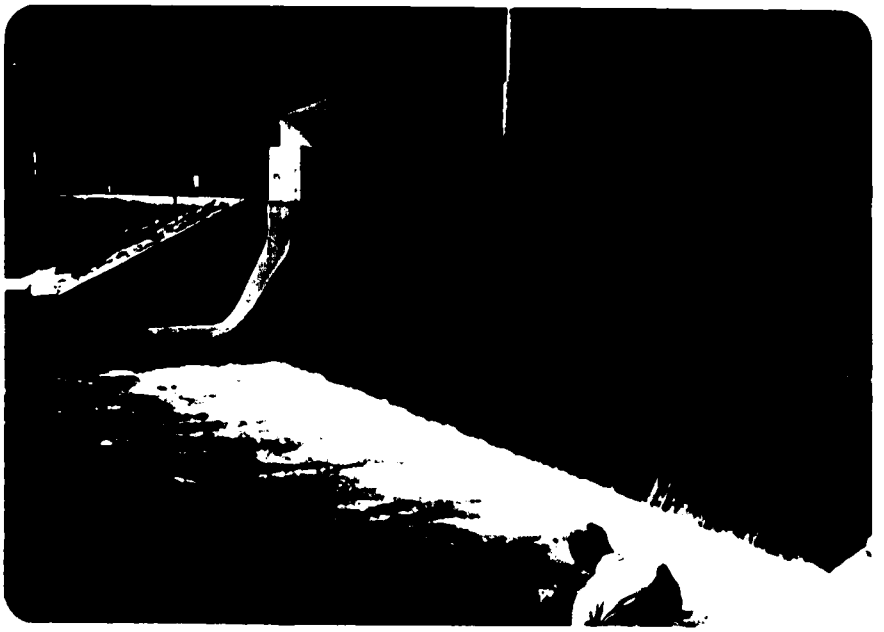
Photograph No. 2

Upstream face (looking east).



Photograph No. 3

Spillway.



Photograph No. 4

Intake tower and bypass conduit (at right end of spillway looking downstream).

APPENDIX D

HYDROLOGY AND HYDRAULICS AND STABILITY ANALYSES

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: Brookville Water Works Dam
(NDI I.D. PA-422)

PROBABLE MAXIMUM PRECIPITATION (PMP) = 23.3 INCHES/24 HOURS[1]

STATION	1	2	3	4	5
Station Description	Lake	Dam			
Drainage Area (square miles)	96.3	-			
Cumulative Drainage Area (square miles)	96.3	96.3			
Adjustment of PMF for Drainage Area (%)[2]	(ZONE 2)				
6 Hours	116	-			
12 Hours	126	-			
24 Hours	141	-			
48 Hours	151	-			
72 Hours	-	-			
Snyder Hydrograph Parameters					
Zone[3]	24	-			
C_p/C_t[4]	0.45/1.6	-			
L (miles)[5]	22.0	-			
L_{ca} (miles)[5]	10.3	-			
$t_p = C_t(L \cdot L_{ca})^{0.3}$ (hours)	8.14	-			
Spillway Data					
Crest Length (ft)	-	100			
Freeboard (ft)	-	7.6			
Discharge Coefficient	-	3.6[6]			
Exponent	-	1.5			

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.
(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.
(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).
(4) Snyder's Coefficients.
(5) L = Length of longest water course from outlet to basin divide.
L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.
(6) Assumed based on field observations.

STORAGE VS. ELEVATION

ELEVATION	ΔH, FEET	AREA (ACRES)[1]	ΔVOLUME (ACRE-FEET)[2]	STORAGE (ACRE-FEET)
1227[3]	13	18.4	502.5	0
1240	20	63.4	2102.8	502.5
1260		153.4		2605.3

(1) Planimetered from USGS maps.
(2) $\Delta Volume = \Delta H/3 \ (A_1 + A_2 + \sqrt{A_1 A_2})$.
(3) Normal pool elevation.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1                A1       SNYDER UNIT HYDROGRAPH, FLOOD ROUTING AND DAM OVERTOPPING ANALYSES
    2                A2       BROOKVILLE DAM, JEFFERSON COUNTY, NDI-I. D. PA. 422       PROJECT NO. 79-543-18
    3                A3       FOR 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, AND 50% PMF
    4                B     300        0       30        0        0        0        0        0       -4        0
    5                B1      5
    6                J       1        9        1
    7                J1   0.10     0.15     0.20     0.25     0.30     0.35     0.40     0.45     0.50
    8                K       0        1                                          1
    9                K1       CALCULATION OF SNYDER INFLOW HYDROGRAPH TO BROOKVILLE DAM
   10                M       1        1     96.3               96.3                                1
   11                P              23.3      116      126      141      151
   12                T                                                          1.0      .05             0.0003
   13                W    8.14     0.45
   14                X    -1.0    -0.05      2.0
   15                K       1        2                                          1
   16                K1       ROUTING FLOW THROUGH BROOKEVILLE DAM (NDI-I. D. PA. 422).
   17                Y                                          1        1
   18                Y1      1                                                -1227.0
   19                $A   18.4     63.4    153.4
   20                $E 1227.0   1240.0   1260.0
   21                $$ 1227.0    100.0      3.6      1.5
   22                $D 1234.6      3.1      1.5    270.0
   23                $L   25.0     50.0    237.5    247.5    260.0    270.0
   24                $V 1234.6   1234.8   1234.9   1235.0   1236.0   1238.8
   25                K      99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

				RATIOS APPLIED TO FLOWS								
OPERATION	STATION	AREA	PLAN	RATIO 1 .10	RATIO 2 .15	RATIO 3 .20	RATIO 4 .25	RATIO 5 .30	RATIO 6 .35	RATIO 7 .40	RATIO 8 .45	RATIO 9 .50
HYDROGRAPH AT	1	96.30	1	8401.	12601.	16802.	21002.	25202.	29403.	33603.	37804.	42004.
	(	249.42)	(	237.88)(	356.83)(	475.77)(	594.71)(	713.65)(	832.60)(	951.54)(	1070.48)(	1189.42)
ROUTED TO	2	96.30	1	8382.	12578.	16774.	20969.	25164.	29359.	33554.	37748.	41943.
	(	249.42)	(	237.35)(	356.16)(	474.99)(	593.79)(	712.57)(	831.35)(	950.14)(	1068.92)(	1187.69)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1227.00	1227.00	1234.60
STORAGE	0.	0.	222.
OUTFLOW	0.	0.	7543.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1235.08	.48	242.	8382.	4.50	48.00	0.00
.15	1236.60	2.00	312.	12578.	13.00	47.50	0.00
.20	1237.77	3.17	372.	16774.	17.50	47.50	0.00
.25	1238.80	4.20	430.	20969.	21.00	47.50	0.00
.30	1239.74	5.14	486.	25164.	24.00	47.50	0.00
.35	1240.61	6.01	542.	29359.	26.50	47.50	0.00
.40	1241.43	6.83	597.	33554.	28.00	47.50	0.00
.45	1242.21	7.61	652.	37748.	30.00	47.50	0.00
.50	1242.96	8.36	706.	41943.	32.00	47.50	0.00

OVERTOPPING ANALYSIS SUMMARY

DAPPOLONIA
CONSULTING ENGINEERS, INC

By WTC Date 5/27/80 Subject BROOKVILLE DAM Sheet No. ___ of ___
Chkd. By BE Date 5/28/80 H&H Proj. No. 78-543-18

100 YEAR PEAK INFLOW USING COE REGRESSION RELATIONSHIP

FOR WATERSHED BETWEEN 25 TO 90 SQ MILE

$$Q_{100} = 192.52\,(A\sqrt{S})^{0.6408}\,(L)^{0.2023}\left(\frac{W_b}{L_b}\right)^{0.4027}$$

Where A = DRAINAGE AREA
= 96.3 SQ. MILE
L = 0.7 LENGTH OF LONGEST COURSE
= 0.7 x 22 mile
= 15.4 mile
ELEVATION @ 15.4 mile u/s from spillway = 1420
ELEVATION @ lake = 1227
ΔH = 193'
S = SLOPE OF FIRST L REACH IN FT/MILE

$$= \frac{\Delta H}{0.7\ \text{length}}$$

$$= \frac{\Delta H}{L} = \frac{193'}{15.4} = 12.53\ \frac{FT}{MILE}$$

W_b = WIDTH OF APPROXIMATE RECT. SHAPE WATERSHED
= 7.2 mile
L_b = LENGTH OF APPROXIMATE RECT. SHAPE WATERSHED
= 13.4 mile

$$Q_{100} = (192.52)\left[(96.3)(\sqrt{12.53})\right]^{0.6408}(15.4)^{0.2023}\left(\frac{7.2}{13.4}\right)^{0.4027}$$

$$= (192.52)(41.97)(1.74)(0.78)$$

$$= 10963\ \text{cfs}$$

say 11000 cfs for 100 YR STORM PEAK INFLOW

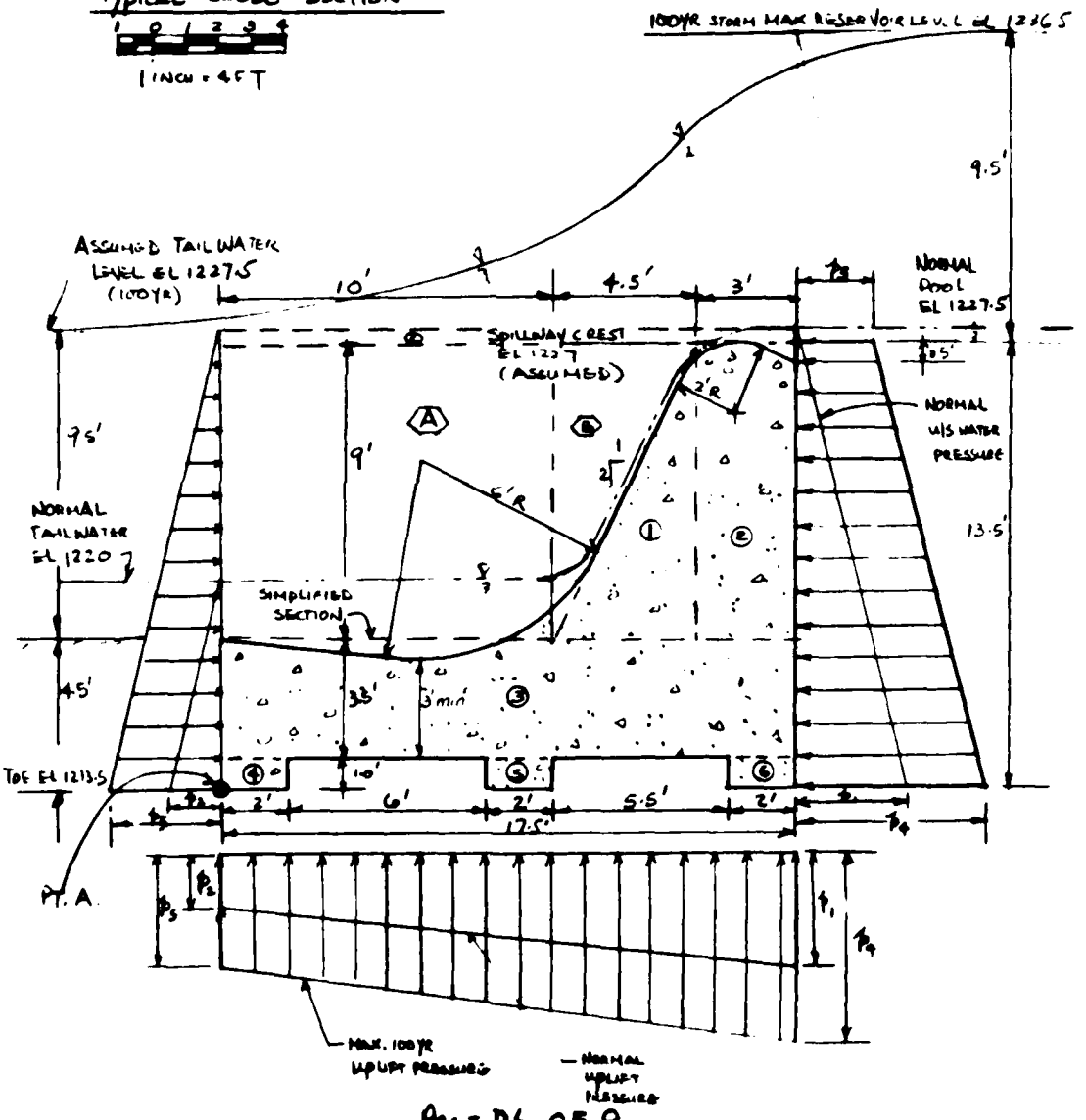
DAPPOLONIA
CONSULTING ENGINEERS INC

By WTC Date 5/29/80 Subject BROOKVILLE WATER MARK DAM Sheet No. 1 of 4
Chkd By [illegible] Date 5-29-80 STABILITY ANALYSIS Proj No 79-543-18

Typical CROSS-SECTION

0 1 2 3 4

1 INCH = 4 FT



DAYTONA
CONSULTING ENGINEERS INC

By WTC Date 5/29/80 Subject BROOKVILLE WATER WORK DAM Sheet No 2 of 4
Chkd By [illegible] Date 5-29-80 STABILITY ANALYSIS Proj No 79-543-18

SPILLWAY STABILITY DURING 100 YR STORM

100 YEAR PEAK DISCHARGE = 11000 cfs (See WTC CALC.)

PMF PEAK DISCHARGE = 84000 cfs (See HEC 1 OUTPUT)

$\frac{11000}{84000} = 0.13$ or 13% PMF

THEN INTERPRATE FROM HEC 1 COMPUTER OUTPUT, THE MAX. RESERVOIR LEVEL COULD REACH TO EL 1236.5 OR 9.5' ABOVE SPILLWAY CREST (1227).

SINCE TAILWATER RATING CURVES ARE NOT AVAILABLE, IT IS ASSUMED THE WATER DEPTH OF TAILWATER IS EQUAL TO THE WATER DEPTH OVER SPILLWAY OR 9.5' for 100 YEAR STORM

BASED ON FIELD OBSERVATION MADE ON 4/24/80 THE NORMAL POOL OF LAKE IS APPROXIMATELY 0.5' ABOVE SPILLWAY CREST OR 1227.5 AND THE TAILWATER WAS 7' BELOW SPILLWAY CREST OR EL 1220.

WT OF CONCRETE & OVERTURNING MOMENT

	WT. OF CONCRETE K-PS		ARM* FT	MOMENT K-'
①	$\frac{1}{2} \times 4.5' \times 9' \times 1' \times .015^{K/F^3} =$	3.04 K	13	39.49
②	$5' \times 9' \times 1' \times .015^{K/F^3} =$	4.05 K	16	64.80
③	$17.5' \times 3.5' \times 1' \times .015^{K/F^3} =$	9.19 K	8.75	80.39
④	$2' \times 1' \times 1' \times .015 =$	0.3 K	1	0.3
⑤	$2' \times 1' \times 1' \times .015 =$	0.3 K	9	2.7
⑥	$2 \times 1 \times 1 \times .015 =$	0.3 K	16.5	4.95
	TOTAL	17.18 K		192.63 K-'

RESULTANT ARM

$X_1 = \frac{192.63}{17.18}$

$= 11.22'$

* ARM ABOUT PT. A OF TOE, TYPICAL

DAPPOLONIA
CONSULTING ENGINEERS INC

By WTC Date 5/29/80 Subject BROOKVILLE WATER WORK DAM Sheet No 3 of 4
Chkd By [illegible] Date 5 29 80 STABILITY ANALYSIS Proj No 78-543-18

WT OF WATER ABOVE SPILLWAY

	WATER ABOVE SPILLWAY	ARM	MOMENT
	K-ips	FT	K-I
A	$10'\times9'\times1'\times0.0624^{K/F^3} = 5.62$	5	28.08
B	$\frac{1}{2}\times4.5'\times9'\times1'\times0.0624 = 1.26$	11.5	14.53
C	$17.5'\times0.5'\times1'\times0.0624 = 0.55$	8.75	4.78
	7.43 K		47.39 K-I
NORMAL TAILWATER	$10\times2\times1\times0.0624 = 1.25^{K}$	5	6.24 (approx. scale)

RESULTANT ARM
$X_2 = \frac{47.39}{7.43}$
$= 6.38'$

WATER PRESSURES & FORCE

DURING NORMAL CONDITION

$p_1 = 0.0624 \times (1227.5 - 1213.5) = 0.0624 \times 14 = 0.87^{KSF}$
$p_2 = 0.0624 \times (1220 - 1213.5) = 0.0624 \times 6.5 = 0.41^{KSF}$

	FORCE		ARM	MOMENT
	K-ips		FT	K-I
UPLIFT	$0.41 \times 17.5' \times 1'$	= 7.1	8.75	62.11
	$\frac{1}{2}\times(0.87-0.41)\times17.5\times1$	= 4.1	11.67	47.78
	TOTAL	= 11.19 K	—	109.88 K-I
U/S	$\frac{1}{2}(0.87)(14)$	= 6.12 K	4.67	28.54 K-I (approx. scale)
D/S	$\frac{1}{2}(0.41)(6.5)$	= 1.32	2.17	2.86

DURING FLOOD

$p_3 = 0.0624\ (1236.5 - 1227) = 0.0624 \times 9.5 = 0.59^{KSF}$
$p_4 = 0.0624\ (1236.5 - 1213.5) = 0.0624 \times 23 = 1.44^{KSF}$
$p_5 = 0.0624\ (1227.5 - 1213.5) = 0.0624 \times 14 = 0.87^{KSF}$

	FORCE		ARM	MOMENT
	K-ips		FT	K-I
UPLIFT (max.)	$0.87 \times 17.5 \times 1$	= 15.23	8.75	133.77
	$\frac{1}{2}(1.44-0.87)(17.5)(1)$	= 4.91	11.67	57.33
		= 20.20		191.10
UPSTREAM	$(0.59)(13.5)(1)$	= 8.0	6.75	54.02
	$\frac{1}{2}(1.44-0.59)(13.5)(1)$	= 5.69	4.50	25.59
		= 13.69		79.61
D/S	$\frac{1}{2}(0.87)(13.5)(1)$	= 5.9	6.75	39.80 (APPROX SCALE)

D'APPOLONIA
CONSULTING ENGINEERS, INC

By SJD Date 6/17/80 Subject BROOKSVILLE WATER WORKS Sheet No. — of —
Chkd. By [illegible] Date _____ DAM Proj. No. 79-SHS-1R

REFERENCE : SEE CALCULATIONS OF WTC

A) ASSUME UPLIFT PRESSURE WILL NOT INCREASE SIGNIFICANTLY DURING FLOOD

FS SLIDING : $\frac{(17.18 \times 7.43 - 19) \tan 32 + 0.9 + 25.2^{*}}{13.69} = 2.00$ OK.

(* COHESIVE FORCE)

FS AGAINST OVERTURNING $e_o = \frac{\Sigma M}{\Sigma N} = \frac{192.67 + 147.39 + 39.90 - 109.88 - 79.61}{17.18 + 7.43 - 11.19} = \frac{96.39}{13.42} = 6.73^{FT}$

ECCENTRICITY OF RESULTANT $e = \frac{17.5}{2} - 6.73 = 2.02^{FT}$, $\frac{L}{6} = \frac{17.5}{6} = 2.9^{FT} > 2.02^{FT}$ OK.

B)

FS SLIDING : $\frac{(17.18 + 7.43 - 20.2) \tan 32 + 0.9 + 25.2^{*}}{13.69} = 2.47$ OK

FS AGAINST OVERTURNING $e_o = \frac{\Sigma M}{\Sigma N} = \frac{192.67 + 147.39 + 39.90 - 191.10 - 79.61}{17.18 + 7.43 - 20.20} = \frac{279.82 - 272.71}{4.41} = 2.07^{FT}$

ECCENTRICITY OF RESULTANT $e = \frac{17.5}{2} - 2.07 = 6.68^{FT}$ $\frac{L}{6} = \frac{17.5}{6} = 2.9^{FT} < 6.68^{FT}$

$\sigma_T = \frac{N}{A} + \frac{M}{S} = \frac{4.41}{17.5} + \frac{9.11}{5.04} = 0.43^{KSF}$

* COHESIVE FORCE AT BASE ASSUMING C = 10 PSI

$\frac{17.5 \times 1 \times 144 \times 10}{1000} = 25.2^{K}$

NOTE

$\phi = 32^{\circ}$ & C = 10 PSI WERE ASSUMED AS A LOWER BOUND FOR CLAY SHALE WHAT APPEAR TO BE THE FOUNDATION ROCK BASED GENERAL DESCRIPTION OF FOUNDATION MATERIALS.

C) [illegible] CASE (C)

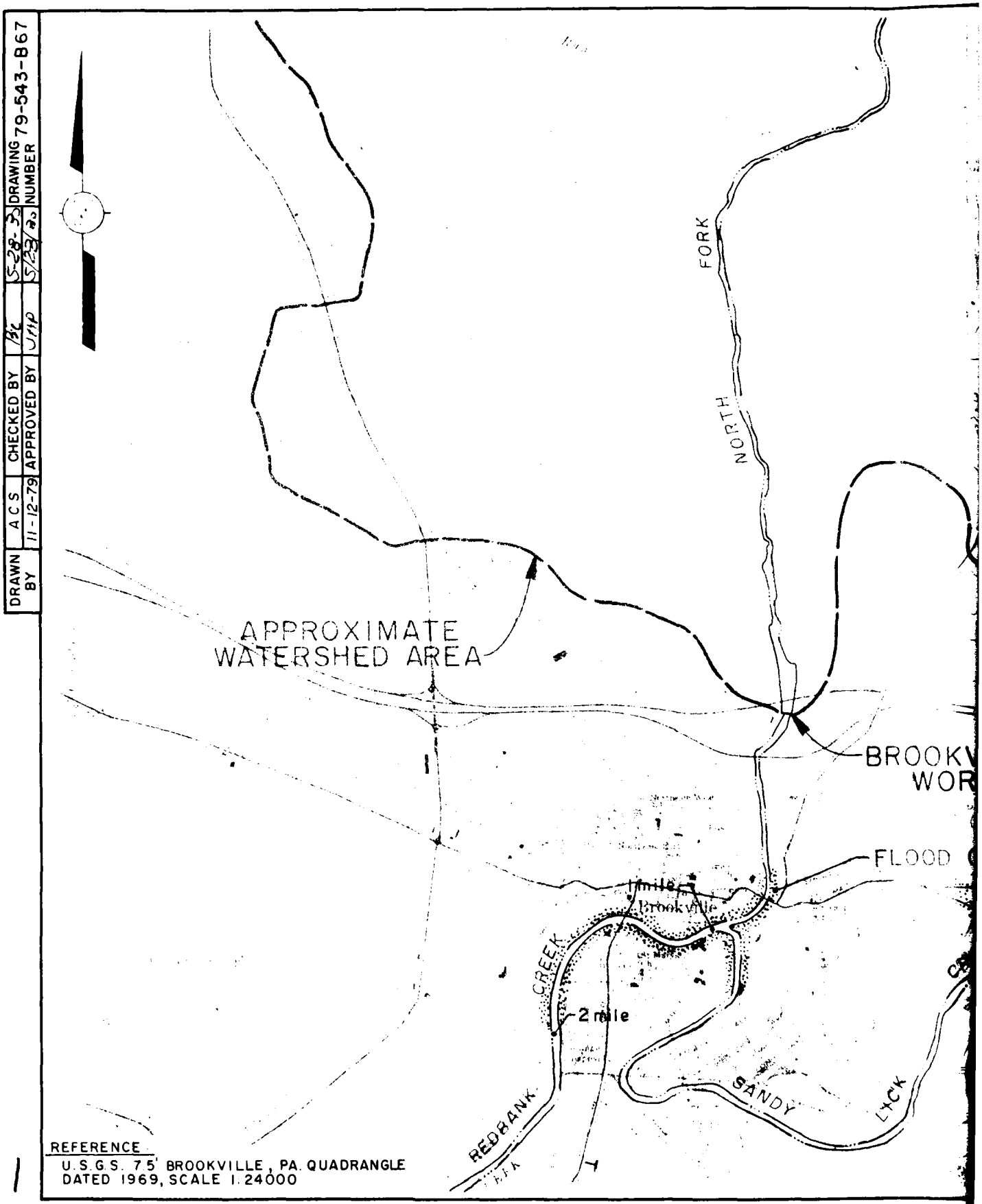
FS SLIDING = $\frac{(17.18 + 1.25 - 11.8) \tan [illegible] + 132 + 25.2^{*}}{6.12} = 5.07$ OK

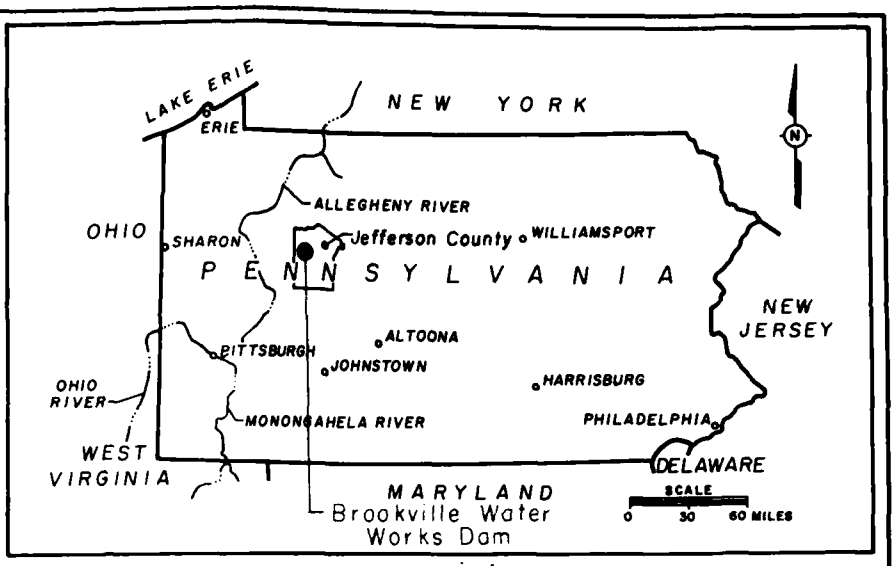
FS AGAINST OVERTURNING $e_o = \frac{\Sigma M}{\Sigma N} = \frac{192.67 + 246 + 24.82 - 28.54 - 109.88 - 2.71}{15.18 + 1.25 + 11.99} = \frac{8.54}{27.42} = 0.31$

ECCENTRICITY OF RESULTANT $e = \frac{17.5}{2} - 8.74 = 0.01^{FT}$ $\frac{L}{6} = \frac{17.5}{6} = 2.91^{FT} > 0.01^{FT}$ OK.

APPENDIX E

PLATES


DRAWN BY
A C S
11-12-79
CHECKED BY
APPROVED BY
DRAWING NUMBER
79-543-B67
APPROXIMATE WATERSHED AREA
FORK
NORTH
BROOKV
WOR
FLOOD
1mile
Brookville
CREEK
2 mile
SANDY
LICK
REDBANK
REFERENCE
U.S.G.S. 7.5' BROOKVILLE, PA. QUADRANGLE
DATED 1969, SCALE 1:24000



KEY PLAN

NORTH

BROOKVILLE WATER WORKS DAM

FLOOD CONTROL PROJECT

CREEK

SANDY LICK

SCALE

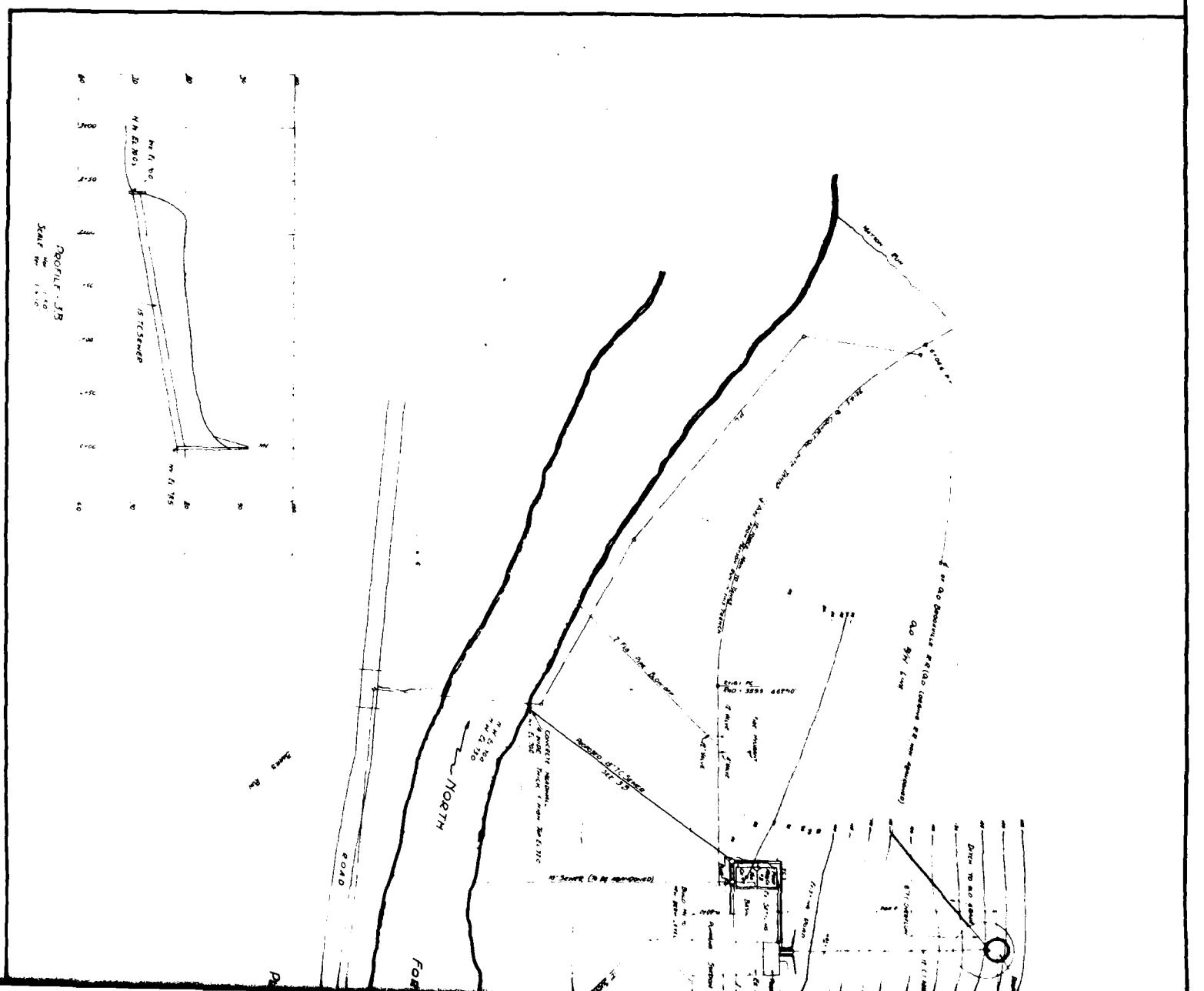
0 2000 4000 6000 FEET

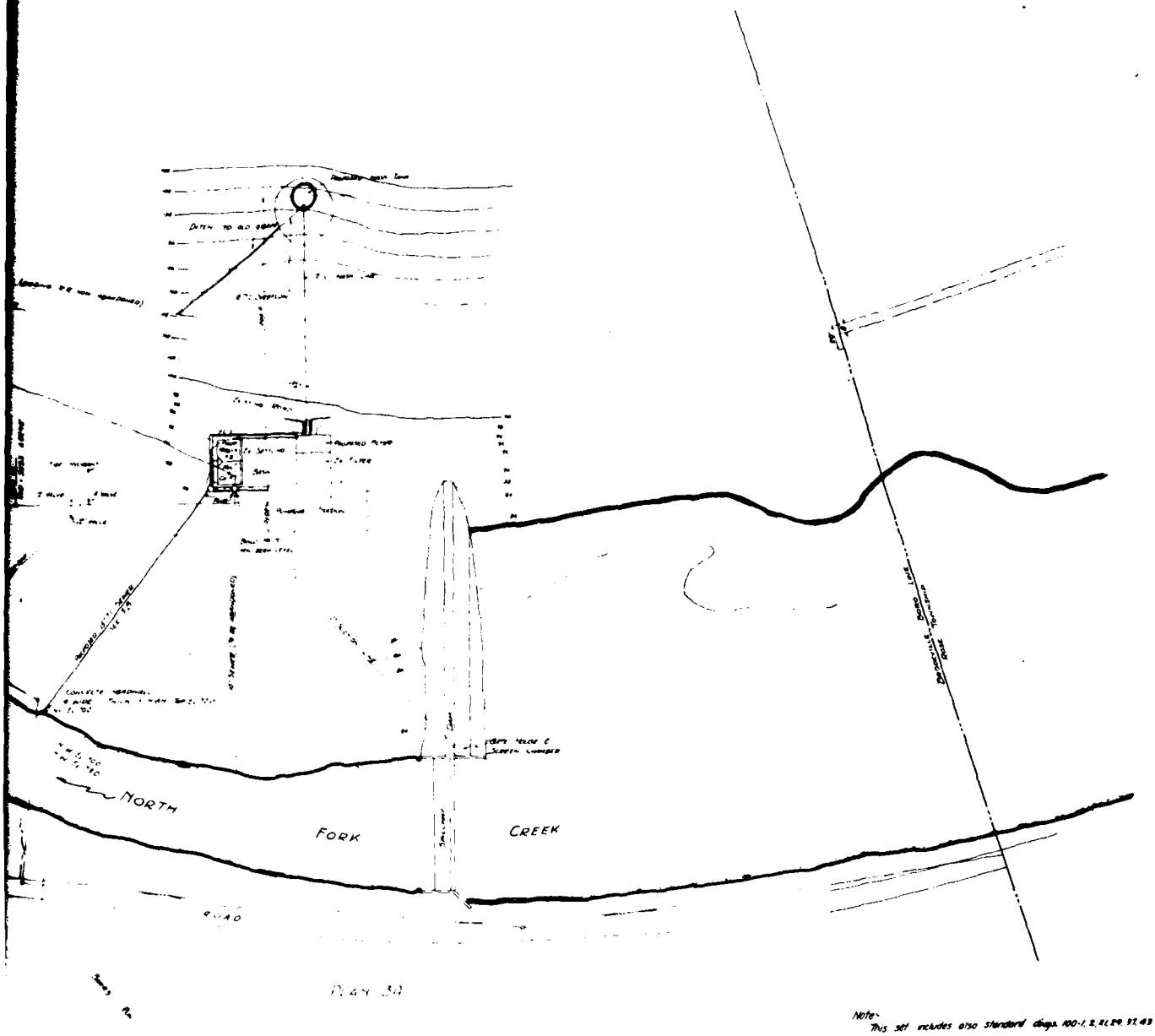
PLATE I

BROOKVILLE WATER WORKS DAM
VICINITY, FLOOD PLAIN & WATERSHED MAP

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY	JST	5-28-80	DRAWING NUMBER 79-543-868
	5.28.80	APPROVED BY	JRP	5/28/80	





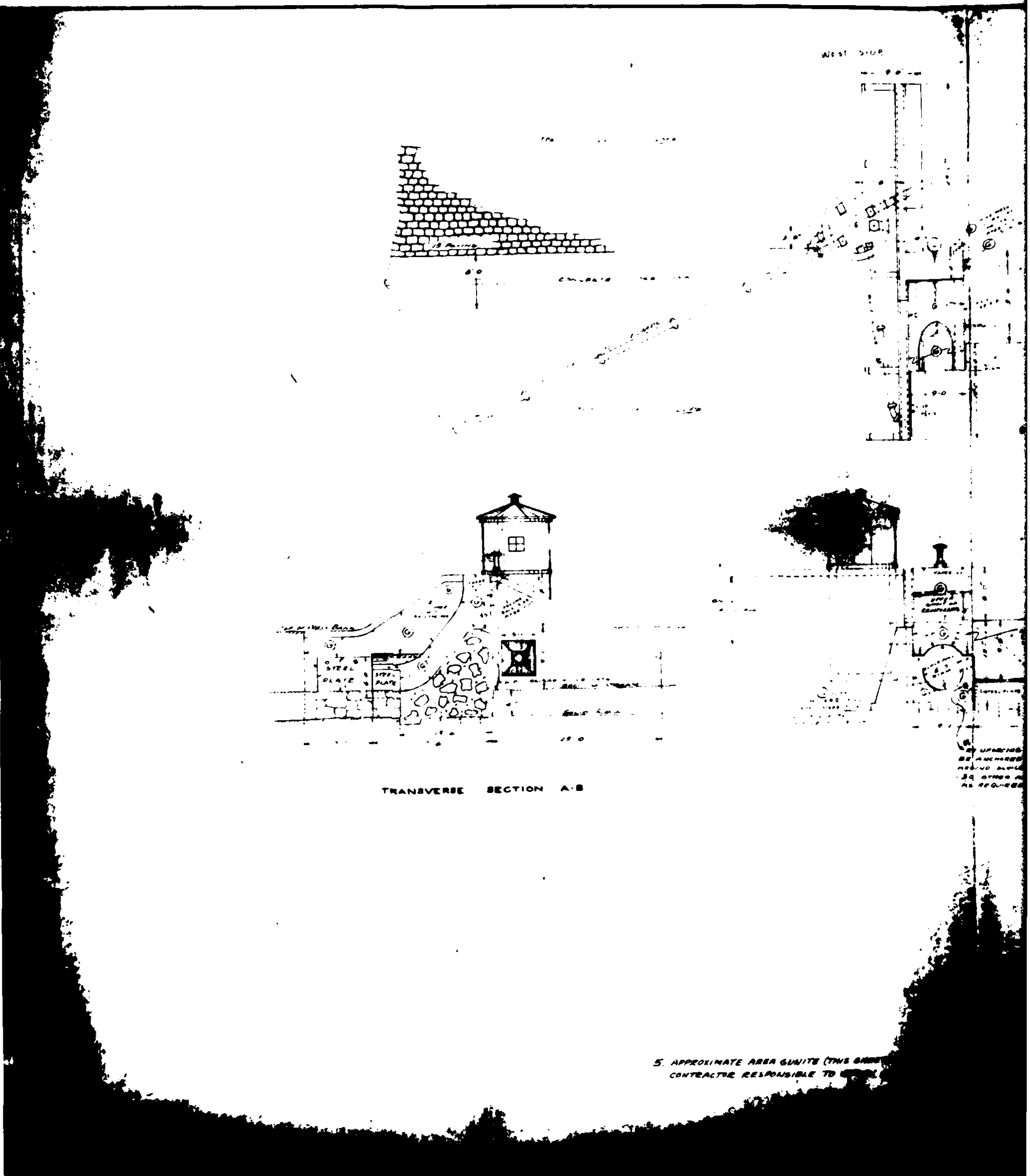
REVISIONS	APPROVAL

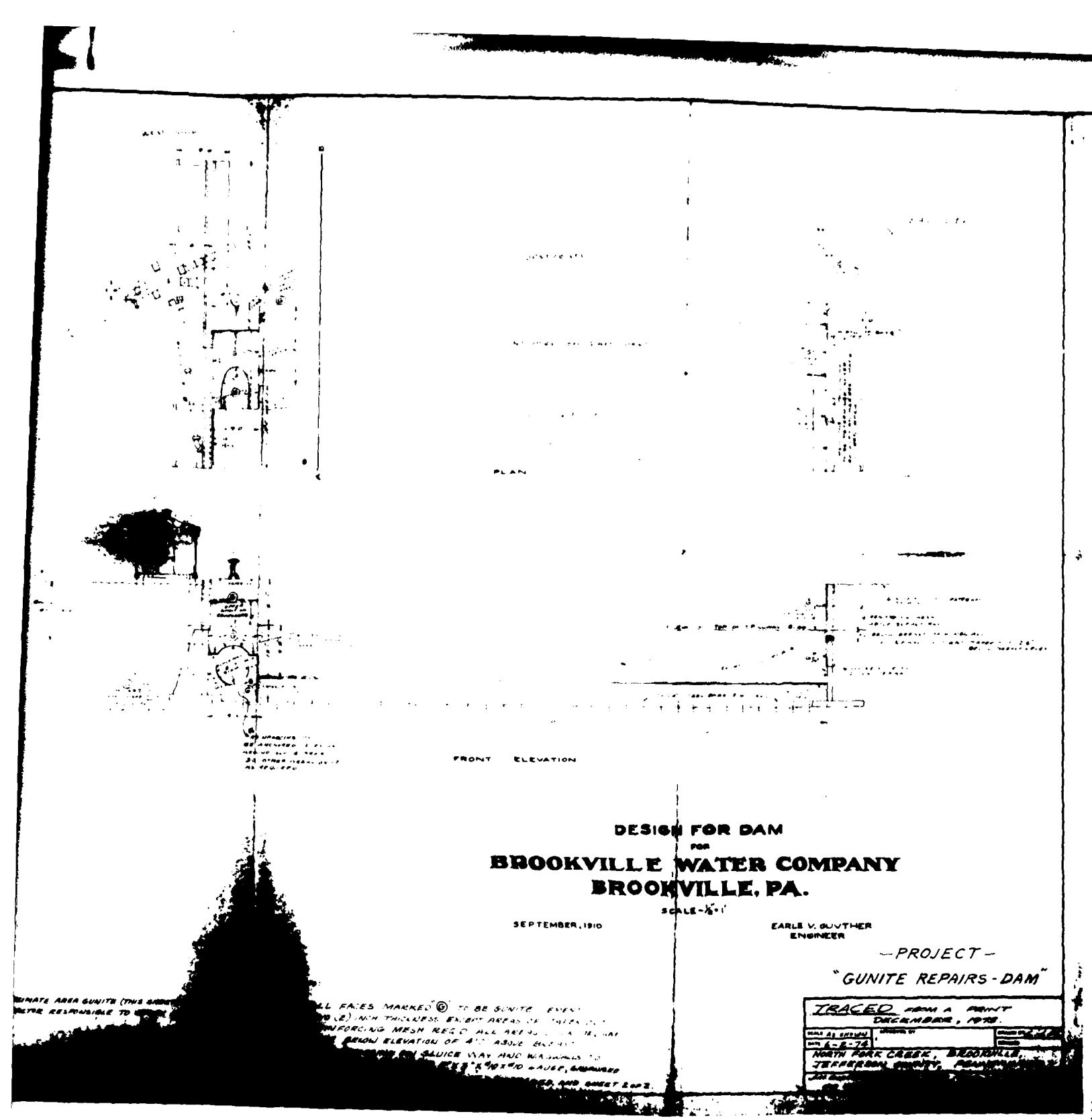
BROOKVILLE, PA.
WATER WORKS
FILTER PLANT IMPRVMNTS
GEN'L LOCATION PLAN.
May - 1985
Scale: 1"=50'
321-3

PLATE 2

D'APPOLONIA

DRAWN BY	ACS 5-28-80	CHECKED BY	BE 5-23-8?	DRAWING NUMBER
		APPROVED BY	JAP 5/23/8?	79-543-B69





DESIGN FOR DAM
FOR
BROOKVILLE WATER COMPANY
BROOKVILLE, PA.

SCALE-½"=1'

SEPTEMBER, 1910

EARLE V. GUYTHER
ENGINEER

—PROJECT—
"GUNITE REPAIRS - DAM"

TRACED FROM A PRINT
DECEMBER, 1910.

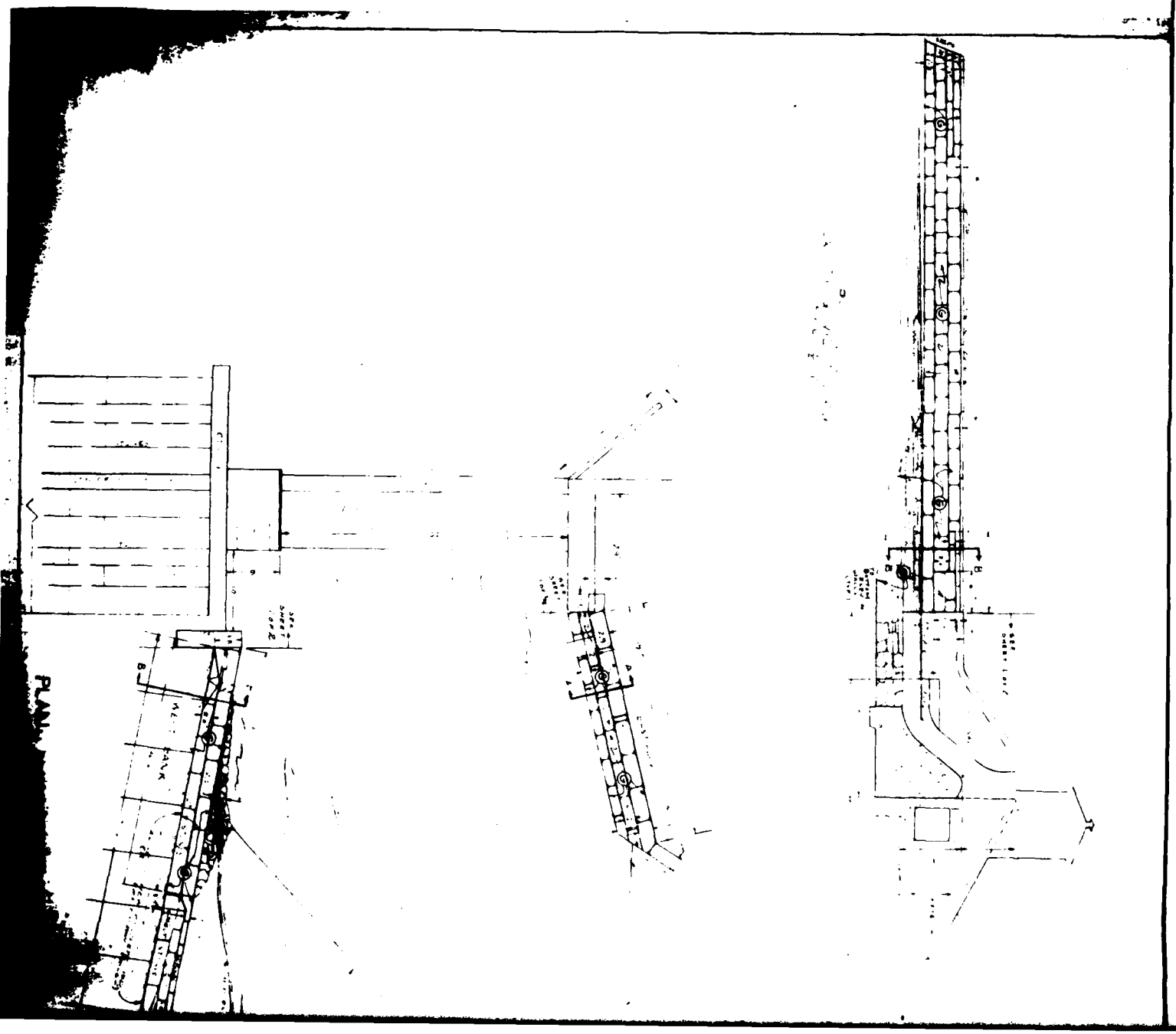
DATE 6-6-74
NORTH FORK CREEK, BROOKVILLE,
JEFFERSON COUNTY, PENNSYLVANIA

PLATE 3

D'APPOLONIA

2

DRAWN BY	ACS	CHECKED BY	BE	5-28-80	DRAWING NUMBER	79-543-B70
	5-28-80	APPROVED BY	JHP	5/28/80		



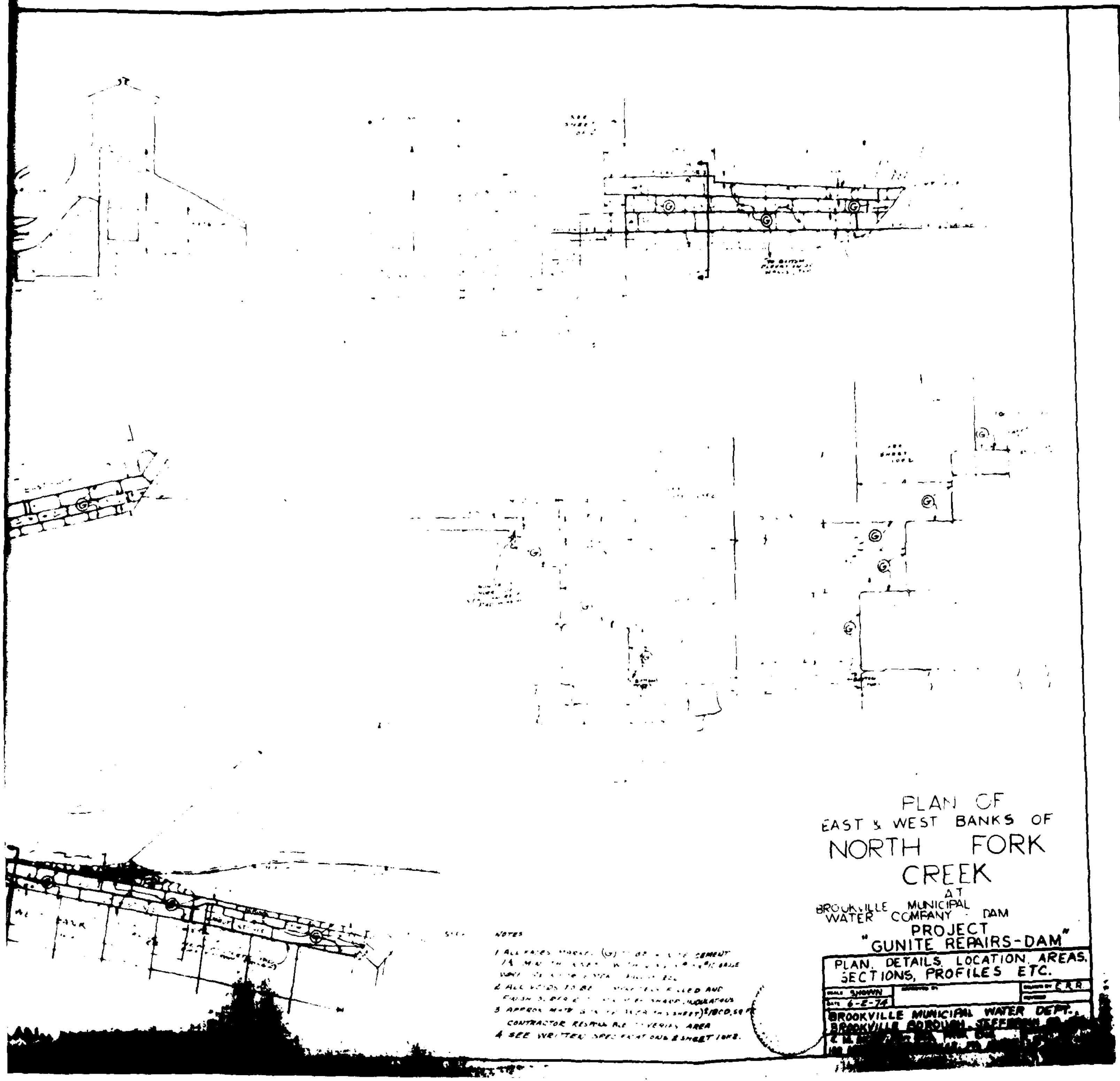
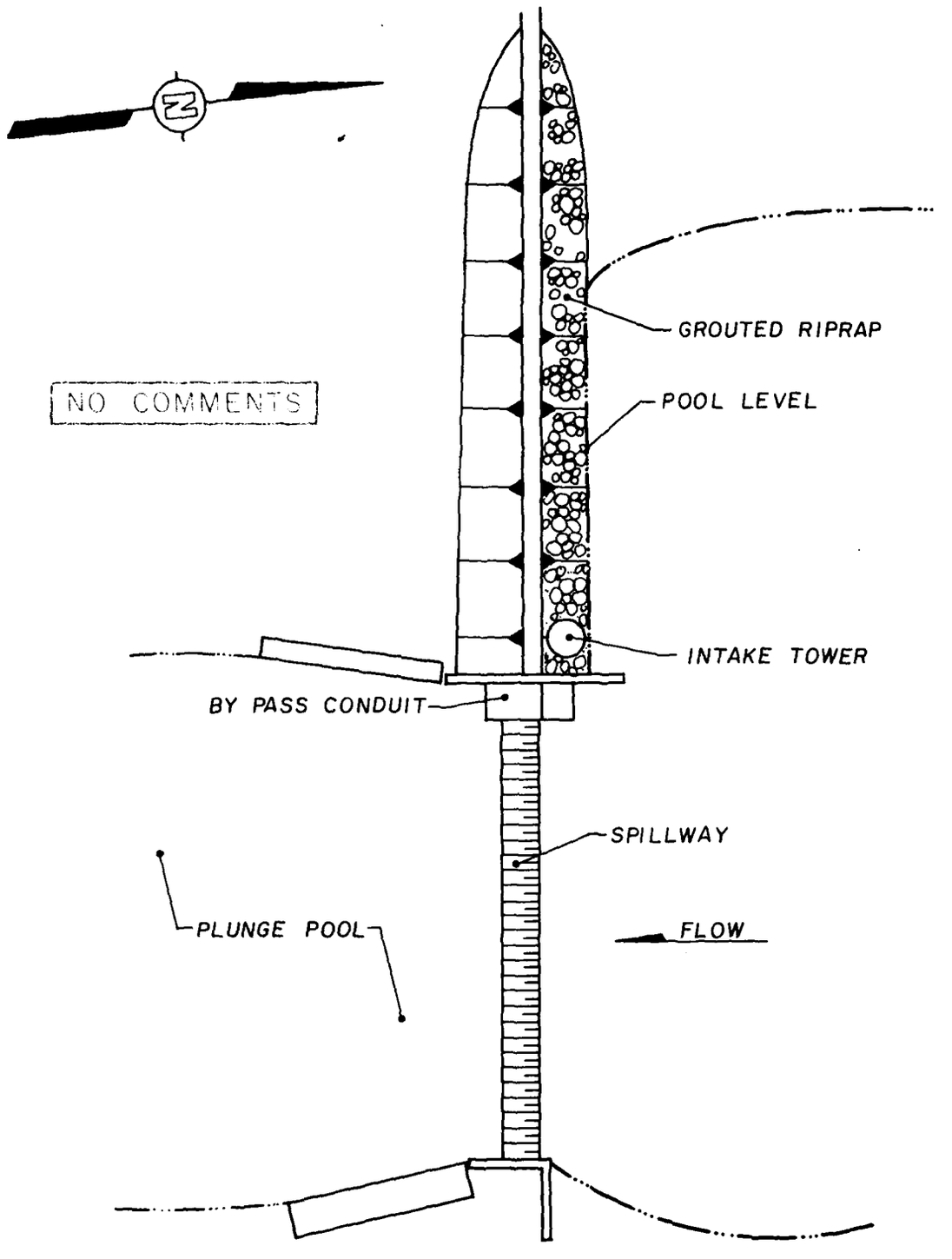


PLATE 4

D'APPOLONIA

DRAWN BY	ACS	CHECKED BY	BC	5-28-80
	5-21-80	APPROVED BY	JHP	5/29/80

DRAWING NUMBER 79-543-A43



NO COMMENTS

NOTES:

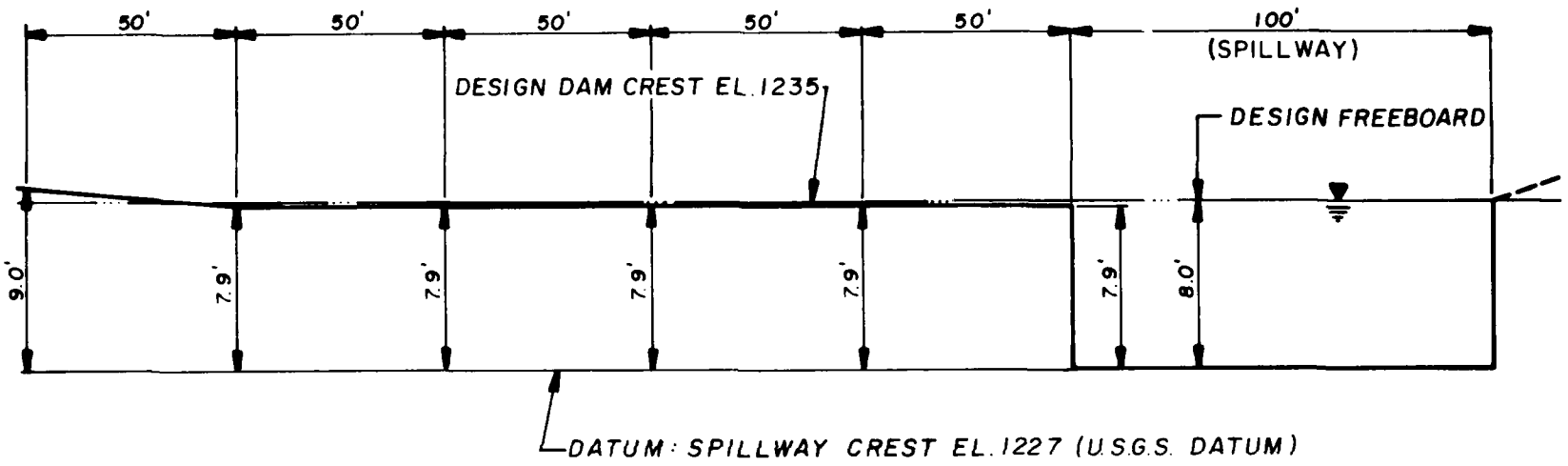
1. POOL LEVEL DATE OF INSPECTION: 1.0 FT. ABOVE SPILLWAY CREST

PLATE 5

BROOKVILLE WATER WORKS DAM
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE: APR. 24, 1980

DAPPOLONIA

DRAWN BY	ACS	CHECKED BY		5-28-80	DRAWING NUMBER 79- .3-A44
	5-21-80	APPROVED BY		5/29/80	



DAM CREST PROFILE
(LOOKING DOWNSTREAM)

NOTES:

1. DAM CREST IS SURVEYED RELATIVE TO SPILLWAY CREST LEVEL
2. DATUM ELEVATION IS INTERPOLATED FROM U.S.G.S. MAPS, IS THEREFORE, APPROXIMATE

PLATE 6

BROOKVILLE WATER WORKS DAM
DAM CREST SURVEY
FIELD INSPECTION DATE: APR. 24, 1980

DAMPOLONIA

APPENDIX F

REGIONAL GEOLOGY

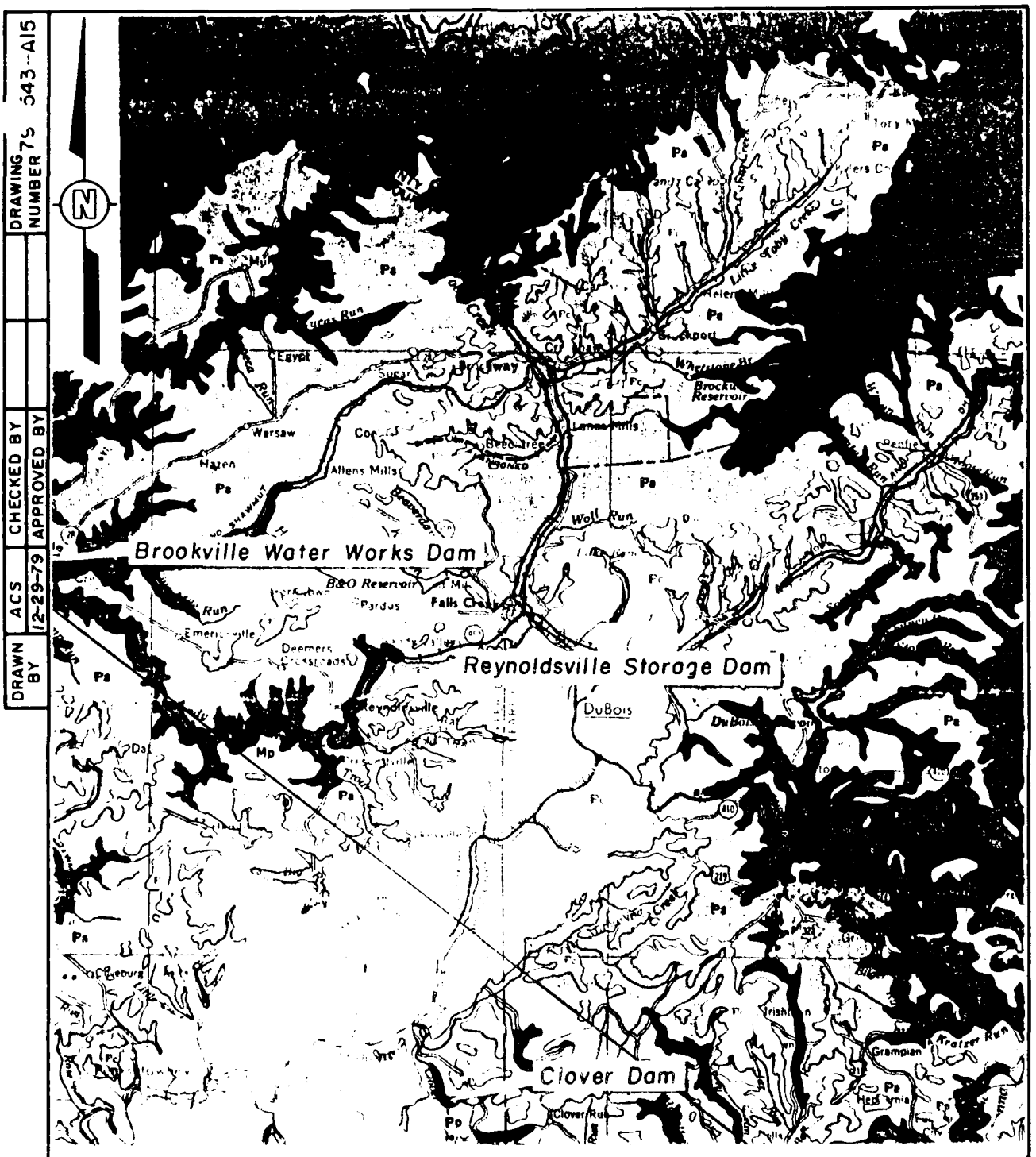
APPENDIX F

REGIONAL GEOLOGY
BROOKVILLE WATER WORKS DAM

Brookville Water Works Dam is located in the central area of the Appalachian Plateau Province which is characterized by broad, nearly level ridges and deep steep valleys. Strata in the vicinity of the dam have been gently folded to form the Brookville Anticline which trends to the northeast.

The dam lies near the contact of the Pottsville Series and Allegheny Group, both of Pennsylvanian Age. Strata along the valley bottom belong to the Pottsville which is primarily hard coarse-grained sandstones and conglomerates with irregular shale beds. The Allegheny lies above the Pottsville and occurs along the valley slopes. This formation is comprised of shales, sandstones, and several minable coals. The Vanport Limestone is contained in this formation.

No underground coal mines are known to exist near the dam.



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BROOKVILLE WATER WORKS, REYNOLDSVILLE STORAGE AND CLOVER DAMS

GEOLOGY MAP

SCALE

0 2 4 6 8 10 miles

REFERENCE

GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA, DEPT. OF INTERNAL AFFAIRS, DATED 1960. SCALE 1" = 4 MILES

DAMPOLONIA

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	12-31-79	APPROVED BY		

LEGEND

Pc

Conemaugh Formation

Cyclic sequences of red and gray shales and siltstones with thin limestones and coals, massive Mahoning Sandstone commonly present at base; Ames Limestone present in middle of sections, Brush Creek Limestone in lower part of section.

Pottsville Group

Light gray to white, coarse grained sandstones and conglomerates with some interbedded coal; excludes Sharp Mountain, Schuylkill, and Tumbling Run Formations.

Allegheny Group

Cyclic sequences of sandstone, shale, limestone and coal; numerous commercial coals, limestones thicken westward, Vanport Limestone in lower part of section, includes Freeport, Kittanning, and Clarion Formations.

Clinton Group

Predominantly Rose Hill Formation - Reddish purple to greenish gray, thin to medium bedded, fossiliferous shale with interbedding iron sandstones and local gray, fossiliferous limestone above the Rose Hill is buff to white, quartzitic sandstone (Keefer) overlain by upward with dark gray shale (Rochester).

Dm

Marine beds

Gray to olive brown shales, greywackes, and sandstones; contains Chemung beds and Portage beds separating Rockwell, Trimmers Rock Tully Limestone at base.

Pocono Group

Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale; includes in the Appalachian Plateau Burgoon, Shenango, Cuyahoga, Corsecaug, Corry, and Knapp Formations; includes part of "Oswayo" of M. L. Fuller in Potter and Tioga counties.

Oriskany Formation

White to brown, fine to coarse grained, partly calcareous, locally conglomeratic, fossiliferous sandstone (Ridgeley) at the top; dark gray, hard, limestone with some interbedded shales and sandstones below (Shriver).

Tuscarora Formation

White to gray, medium to thick bedded, fine grained, quartzitic sandstone, conglomeratic in part.

Marcellus Formation

Black, fissile, carbonaceous shale with thick, brown sandstone (Turkey Ridge) in parts of central Pennsylvania.

Onondaga Formation

Greenish blue, thin bedded shale and dark blue to black, medium bedded limestone with shale predominant in most places, includes Selinsgrove Limestone and Needmore Shale in central Pennsylvania and Buttermilk Falls Limestone and Esopus Shale in easternmost Pennsylvania; in Lehigh Gap area includes Palmerton Sandstone and Bowmanstown Chert.

Dme

Wills Creek Formation

Greenish gray, thin bedded, fissile shale with local limestone and sandstone zones, contains red shale and siltstone in the lower part.

Bloomsburg Formation

Red, thin and thick bedded shale and siltstone with local units of sandstone and thin impure limestone, some green shale in places.

McKenzie Formation

Greenish gray, thin bedded shale interbedded with gray, thin bedded, fossiliferous limestone, shale predominant at the base; intraformational breccia in the lower part. Absent in Harrisburg quadrangle and to the east.

Keyser Formation

Dark gray, highly fossiliferous, thick bedded, crystalline to nodular limestone, passes into Manlius, Rondout, and Decker Formations in the east.

Tonoloway Formation

Gray, highly laminated, thin bedded, argillaceous limestone, passes into Bossardsville and Poxono Island beds in the east.

Dck

Catskill Formation

Chiefly red to brownish shales and sandstones; includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.

REFERENCE:

GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA. DEPT. OF INTERNAL AFFAIRS, DATED 1960, SCALE 1" = 4 MILES

GEOLOGY MAP LEGEND

D'APPOLONIA


DATE
FILME
8